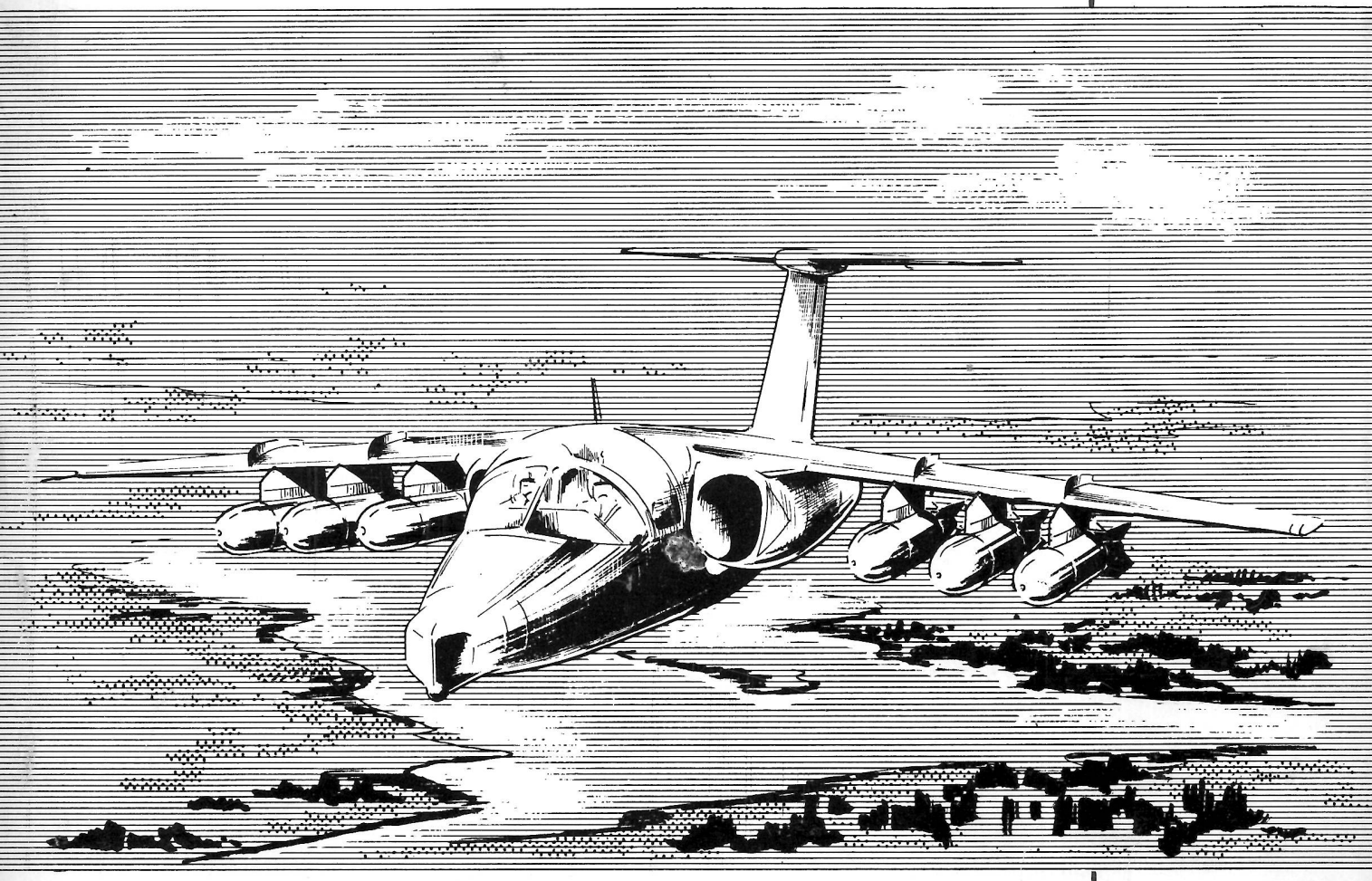


SAAB

SAAB 105 XT

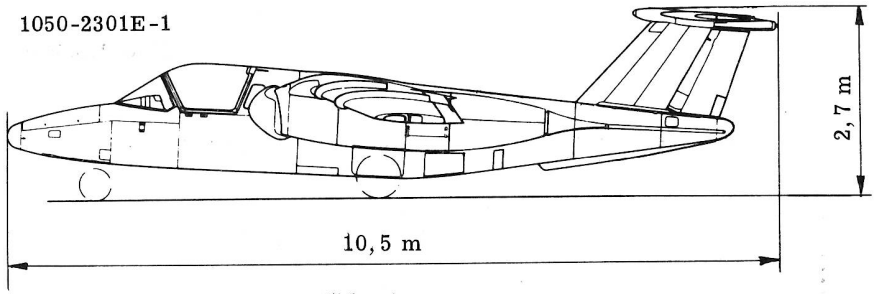
THE SAAB 105 XT

Short description of design, performance and operational use

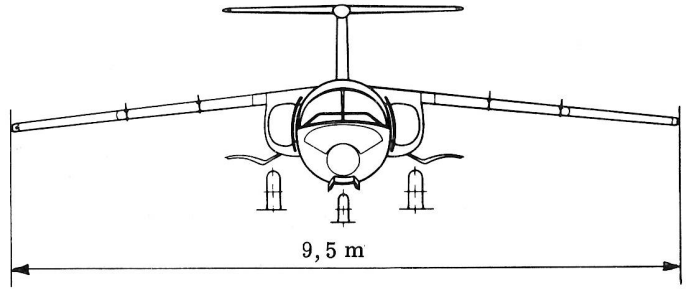
SAAB AKTIEBOLAG

LINKÖPING • SWEDEN

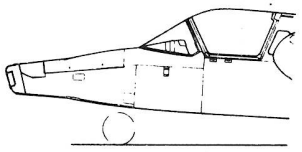
SE-XBZ



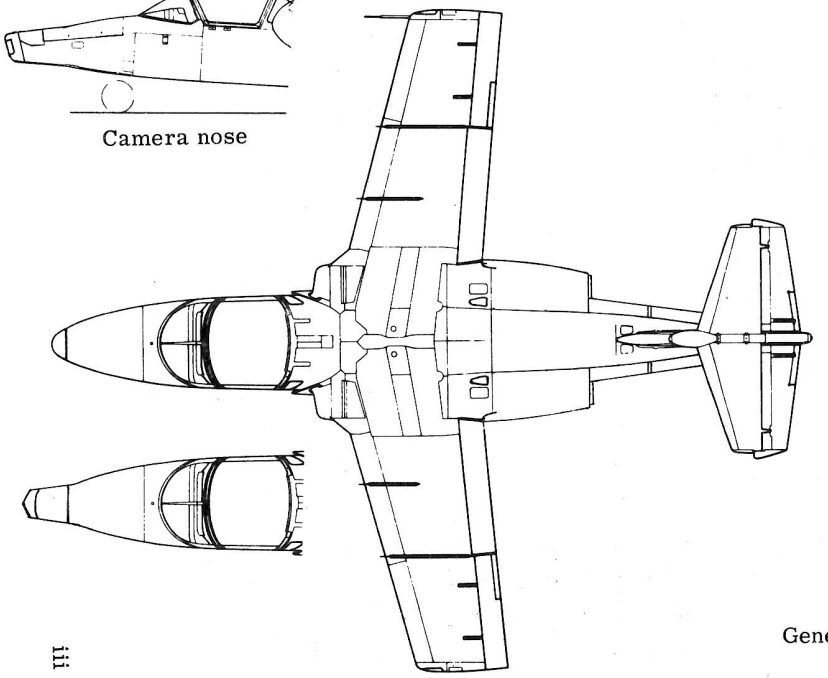
Side view



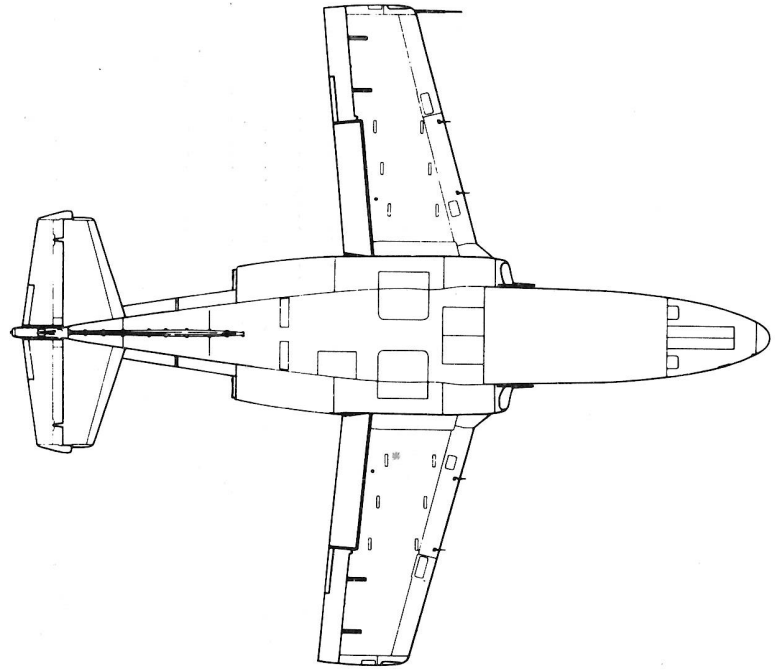
Front view



Camera nose



Top view



Underside

General arrangement

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1050-2103E-1

INTRODUCTION

The SAAB 105 twin jet aircraft made its maiden flight in June 1963 and is now in series production. Deliveries to the Swedish Air Force as SK60 started in 1966.

SK60A is a trainer and liaison aircraft including some structural preparations for armament application.

SK60B is developed from SK60A with complete installations for attack armament. This version can thus be used as a trainer, attack and liaison aircraft.

SK60C is developed from SK60B and includes a panoramic horizon-to-horizon reconnaissance camera in the nose. This version can thus be used as a trainer, attack, reconnaissance and liaison aircraft.

The SAAB 105XT aircraft is a development of the SK60B with the following basic differences:

- Introduction of more powerful engines, i.e. two General Electric J85-17 with 1293 kg (2850 lb) thrust each.
- Increased internal fuel capacity.
- Increased armament load capacity to 2000 kg (4410 lb).
- Improved air conditioning.
- Target towing installation prepared.

The SAAB 105XT aircraft can thus be used as a trainer, attack, reconnaissance, liaison and target towing aircraft. It may also be employed as a limited interceptor.

1050-2103E-1:1

GENERAL DESCRIPTION

The SAAB 105XT multipurpose aircraft is an all-metal high-wing design with the stabilizer on top of the fin. From the outset the SAAB 105XT was designed as a multipurpose military aircraft. Every effort has been made to get a simple and robust design with easy maintenance.

Main performance

Max level speed (ground level)	970 km/h	525 kt
Max level speed (10000 m, 33000 ft)	875 km/h	475 kt
Max dive speed	M = 0.86	M = 0.86
Take-off ground run distance (trainer)	340 m	1115 ft
Landing ground run distance	575 m	1885 ft
Time to 10000 m (33000 ft) (trainer)	4.5 min.	4.5 min.
Range at 11000 m (36000 ft) at 700 km/h (380 kt) including 20 min. reserves	2210 km	1200 nm
Same with 2 x 500 litres (130 US gall) external tanks and 30 min. reserves	2760 km	1490 nm

Attack radius (including reserves):

6 x 500 lb bombs	hi-lo-hi	845 km	455 nm
	lo-lo-lo	345 km	185 nm
One air-to-ground missile One drop tank	hi-lo-hi	1220 km	660 nm
	lo-lo-lo	470 km	255 nm
2 x 500 lb bombs + 2 drop tanks	hi-lo-hi	1460 km	790 nm
	lo-lo-lo	570 km	310 nm

Main data

Length	10.5 m	34 ft 5 in
Height	2.7 m	8 ft 10 in
Span	9.5 m	31 ft 2 in
Track	2.0 m	6 ft 7 in
Wheel base	3.9 m	12 ft 9.5 in
Wing area	16.3 m^2	175 sq.ft
Sweep back at 25 % chord	12.8^o	12.8^o
Dihedral	-6^o	-6^o
Profile thickness root	10.3 %	10.3 %
tip	12.0 %	12.0 %
Weight empty	2515 kg	5550 lb
normal take-off	4420 kg	9750 lb
max take-off	6000 kg	13230 lb
Internal fuel capacity	2050 lit	540 US gall

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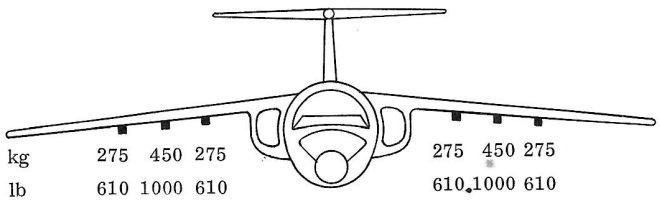

		kg	275	450	275	275	450	275
		lb	610	1000	610	610	1000	610
2 4	1000 lb bombs 500 lb bombs							
6	500 lb bombs							
10	250 lb bombs							
12	80 kg "Lepus" flare bombs							
2 4	30 mm gun pods 500 lb bombs							
2 2	500 lb bombs drop tanks							
4 2	500 lb napalm bombs minigun pods							
12	13,5 cm rockets							
2 8	30 mm gun pods 13,5 cm rockets							
24	5" rockets - 6 pods							
4 2	minigun pods drop tanks							
1 1	SAAB 305 A missile drop tank							
2 2 2	SAAB 305 A missiles IR air-to-air missiles minigun pods							
2 4	30 mm gun pods IR air-to-air missiles							
22	7,5 cm rockets							
	Camera pod Flash pod 2 minigun pods 2 drop tanks							
	Tow reel Target launcher 1 drop tank							

Figure 1. SAAB 105XT. Examples of armament alternatives

Structure

The structure is a riveted skin construction mainly in light alloy. Complete corrosion protection is applied as standard by the factory.

Power Plant

The aircraft has two General Electric J85-17 engines, each with a static thrust of 1293 kp (2850 lb). The engine starting system is electrical. Starts can be made on the internal battery.

Flying Controls

All flying control surfaces are aerodynamically balanced and mechanically controlled (wires and rods). Control of the ailerons is augmented by a hydraulic servo. A pneumatic yaw damper is also included.

Landing Gear

The aircraft has a three-wheel retractable landing gear. The nose wheel is steerable and fitted with shimmy damper. The main wheels are equipped with hydraulic single disc brakes, operated by adjustable pedals. An antiskid device is included.

Cabin

The pressurized and air-conditioned cabin accommodates two side-by-side ejection seats. Alternatively four fixed seats or two seats and a bench seat for three persons can be installed.

Ejection Seats

Minimum altitude for ejection is 130 m (400 ft) with RSAB parachutes and 75 m (230 ft) with GQ parachute. Seats are ejected through the canopy hood. The ejection seats can be used at any airplane speed. The seat acceleration during ejection is less than 20 g.

Fuel system

Fuel is stored in integral tanks in the fuselage and the wings. Usable volume is 2050 litres. Drop tanks can be added. All internal tanks are pressure refuelled from one connection in the starboard wingtip. Fuel is measured by a capacitive system. Negative load-factors are allowed for 15 seconds.

The aircraft can also be refuelled by over-wing filling caps (to 1400 lit).

Installation for 2 x 500 lit drop tanks is optional.

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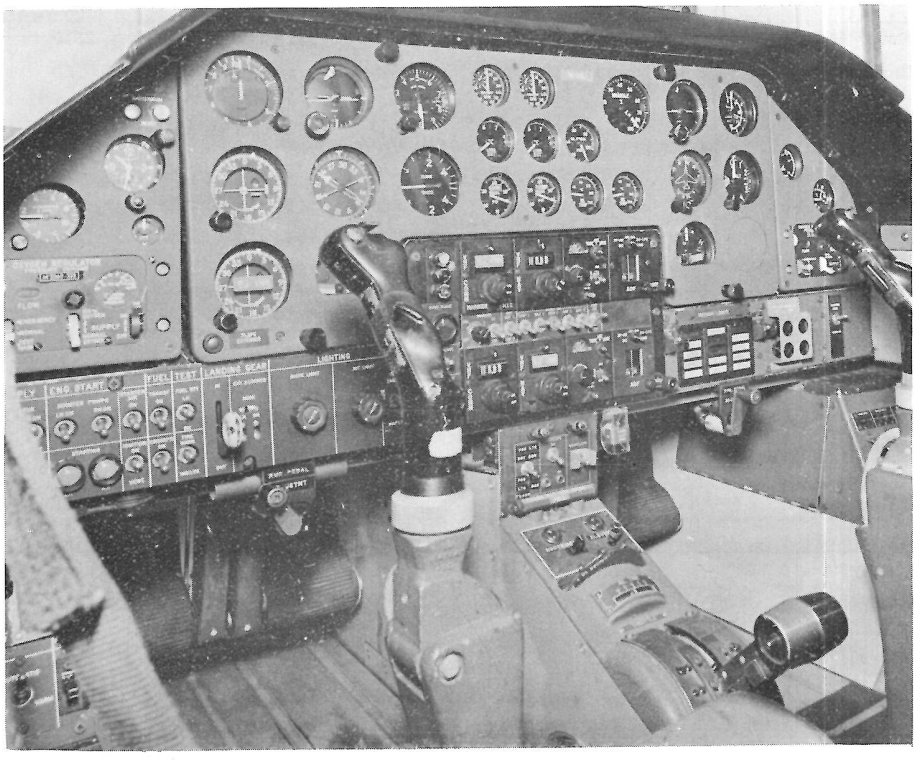


Hydraulic system

The hydraulic system has two pumps (one on each engine), operating at a pressure of 210 kp/cm^2 (3000 psi). The system operates landing gear, flaps, dive brakes, wheel brakes, aileron servo and nose wheel steering.

Electric system

The 2 x 10 kW DC electrical system is fed by two generators (one on each engine). AC converters (2 x 250 VA) are installed in the nose. An external-power connector is installed. The fuses are generally automatic.

Oxygen system

A demand oxygen system is installed with separate regulators for LH and RH front seats, and one common regulator for the rear seats.

Revised

Weight breakdown

Armament alternatives

	6x500 lb bombs		2x1000 lb bombs 4x500 lb bombs		12x13.5 cm rockets		2x30 mm gun pods 4x500 lb bombs	
	kg	lb	kg	lb	kg	lb	kg	lb
Empty weight	2515	5545	2515	5545	2515	5545	2515	5545
Com/Nav eq	50	110	50	110	50	110	50	110
1 ejection seat	61	134	61	134	61	134	61	134
Pilot	90	198	90	198	90	198	90	198
Armam.inst.	22	49	22	49	22	49	22	49
Pylons	108	238	108	238	108	238	108	238
Fuel	1560	3439	1300 *)	2866 *)	1560	3439	1494 *)	3293 *)
Weapon load	1440	3175	1854	4087	504	1111	1660	3660
Take-off weight	5846	12888	6000	13227	4910	10824	6000	13227

*) Reduced fuel quantity

Armament alternatives

	1 drop tank 1 Saab 305A		2 drop tanks 4 Minigun pods		2 drop tanks 2x500 lb bombs	
	kg	lb	kg	lb	kg	lb
Empty weight	2515	5545	2515	5545	2515	5545
Com/Nav eq	50	110	50	110	50	110
1 ejection seat	61	134	61	134	61	134
Pilot	90	198	90	198	90	198
Fuel	1560	3439	1560	3439	1560	3439
Drop tanks	75	165	150	330	150	330
Fuel in drop tanks	380	838	760	1676	760	1676
Pylons	49	108	108	238	108	238
Armam.inst.	47	104	22	49	22	49
Weapon load	322	710	620	1367	480	1058
Take-off weight	5149	11351	5936	13086	5796	12777

	Trainer		Liaison		Reconnaissance	
	kg	lb	kg	lb	kg	lb
Empty weight	2515	5545	2515	5545	2515	5545
Com/Nav eq	50	110	50	110	50	110
Camera nose with camera					38	84
1 ejection seat					61	134
2 ejection seats	115	254				
4 fixed seats			35	77		
Pilot					90	198
Instructor + 1 student	180	397				
Pilot + 3 passengers			360	794		
Fuel	1560	3439	1560	3439	1560	3439
(Ext. tanks)			(150)	(330)	(150)	(330)
(Fuel in ext. tanks)			(760)	(1676)	(760)	(1676)
(Pylons)			(50)	(110)	(50)	(110)
Take-off weight	4420	9745	4520	9965	4314	9510
(Take-off weight with ext. tanks)			(5480)	(12081)	(5274)	(11626)

OPTIONAL EQUIPMENT

- Nav-com.equipment. The aircraft is prepared for:

1 VHF + 1 UHF and Audio Control	(COLLINS)
1 VOR/ILS with marker beacon	(COLLINS)
1 ADF	(MARCONI)

  A wide range of nav-com.alternatives can however be installed on demand.

- Armament equipment.

  Two pylons with 30" and 14" bomb release mechanisms, with provision for rockets.

  Four pylons with 14" bomb release mechanisms and provision for rockets and IR missile launcher.

  Control panels for armament.

  Gunsight Ferranit ISIS F-105.

  Bombsight SAAB BT9R.

  Spoiler to be used as a trimming device in connection with air-to-ground missile installation.

- Armour for crew-protection against small arms ground fire.

- Cabin-hood in stretched acrylic.

- Reconnaissance.
  Camera nose.
  Panoramic camera Fairchild KB-18 with 180^{o} coverage.
  Camera pod with 3-5 cameras
  Flash light pod with 2 flash-units.
- Tape recorder with installation.
- Anti-icing system for aircraft air intakes.
- Ice warning system.
- Target towing equipment and aircraft installation.
- Parachute.
  Swedish Air Force type M46.
  GQ type.
  Plastic seat inset rescue pack.
- Fabric hood for instrument training.
- Four fixed seats or two seats and a bench seat for three persons (replacement for two ejection seats).
- Right hand flight instruments. (Speed Indicator, Horizon, Altitude Indicator, Gyrosyn Compass, Turn and Bank Indicator and Climb Indicator.)
- Two 750 VA inverters (for missiles).
- Bigger batteries for engine starting at low temperatures, Two 34 Ah batteries replace standard two 22 Ah batteries.
- Anti-collision lights.
- Taxilights.
- Fire extinguishers for engine bay.
- External fuel tanks 2 x 500 litres (2 x 130 US gall) with pylons and aircraft installation.

AIRPLANE STRENGTH

The airplane is designed for an ultimate load factor $n_z = 10.5$ at design weights up to 5000 kg (11000 lb). The design limit load factors as functions of weight and C.G.position are shown in figure 2. The maximum take-off weight is 6000 kg (13230 lb).

The landing gear is designed for a touch down sink rate of 3.05 m/s (10 feet/sec) at design landing weight. At higher landing weight the allowable descent velocity it reduced.

The aircraft is designed for a service life of:

approximately	1500 hours for the aircraft in attack use
	3500 hours for the aircraft in trainer use
	15000 hours for the aircraft in liaison use

The maximum design IAS is 1000 km/h (541 kt), corresponding to M = 0.81 at sea level and q = 4800 kp/m^2 (980 lb/ft^2).

The maximum IAS is for

extending and retracting landing gears and flying with landing gears down	400 km/h (216 kt)
extending flaps to landing position	350 km/h (189 kt)

The cabin is designed for an operating pressure of 0.30 kp/cm^2 (4.3 psi) and tested to have a safe life of at least 15000 pressurisation cycles.

The windshield is proven capable of withstanding a bird of 1 kg (2.2 lb) at 670 km/h (360 kt) without penetration.

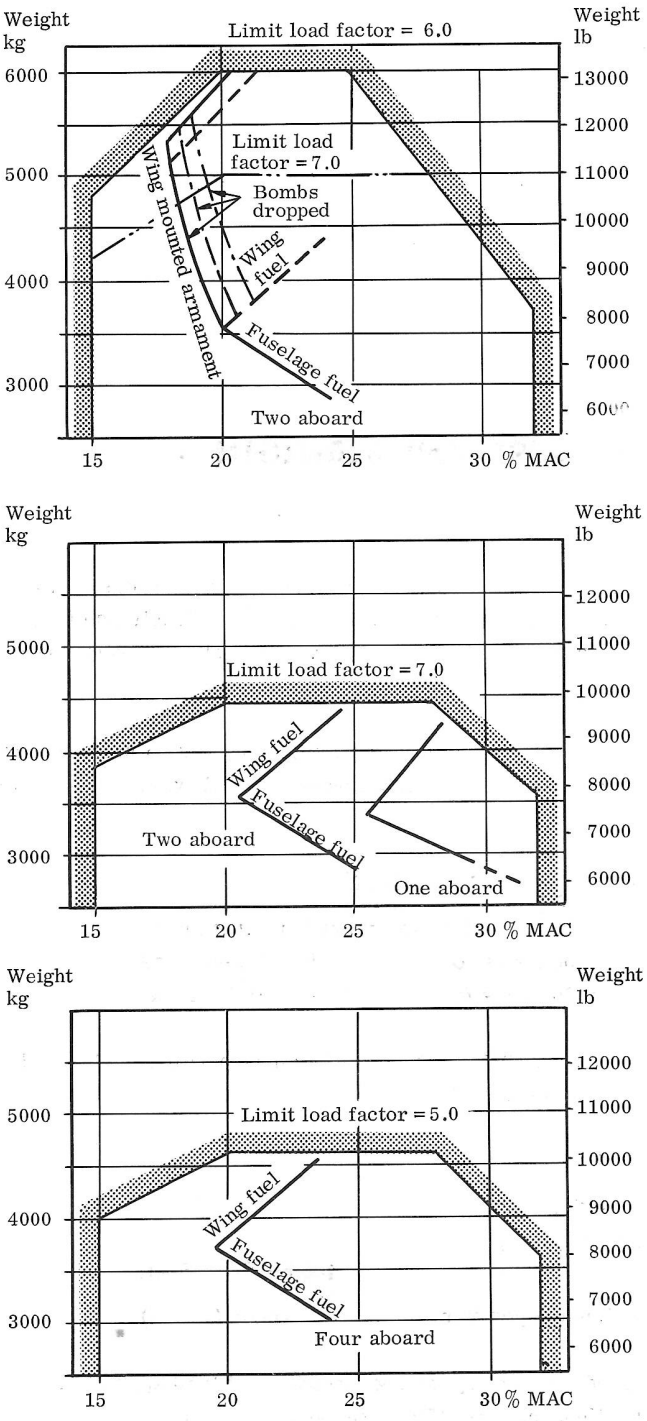


Figure 2. Limit load factor as a function of weight and C.G. position

BASIC PERFORMANCE

Take-off distance versus weight	figure 3
Take-off distance at increased temperature and altitude	figure 4, 5
Landing distance versus weight	figure 6
Rate of climb	figure 7
Time to climb	figure 8, 9
Equilibrium speed	figure 10
Flight envelope limitations	figure 11
Ferry range	figure 12

Further performance figures are given in the section "Operational characteristics".

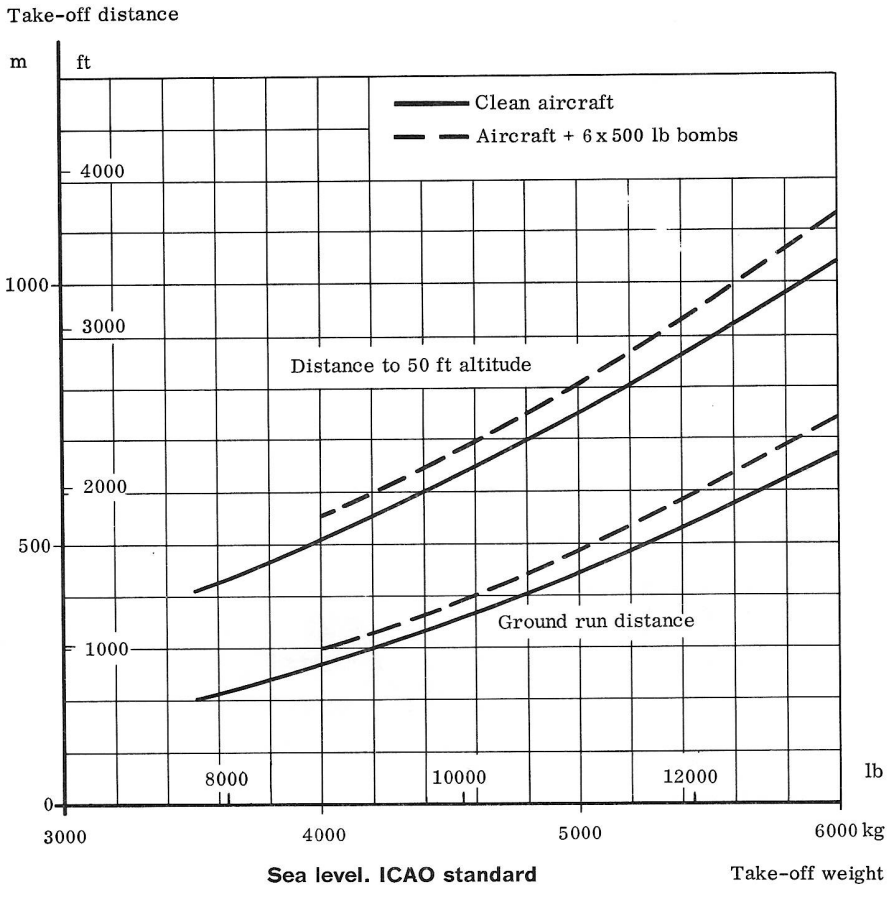


Figure 3. Take-off distance. Flaps 20^{o}

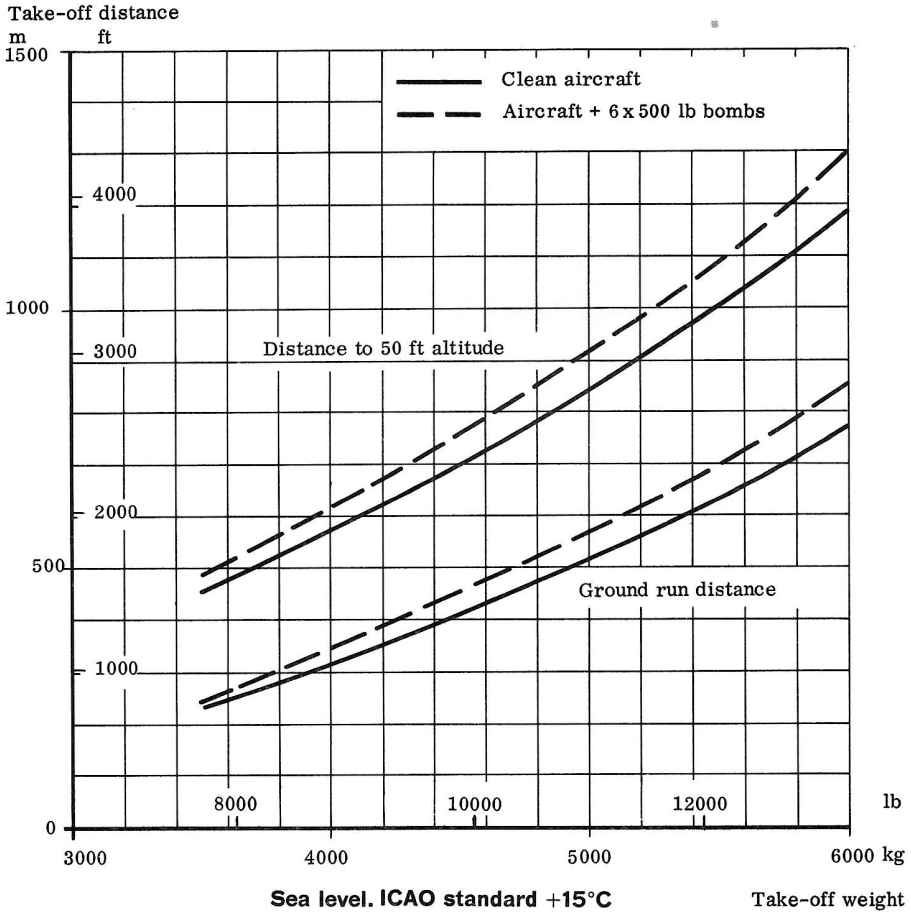


Figure 4. Take-off distance. Flaps 20°

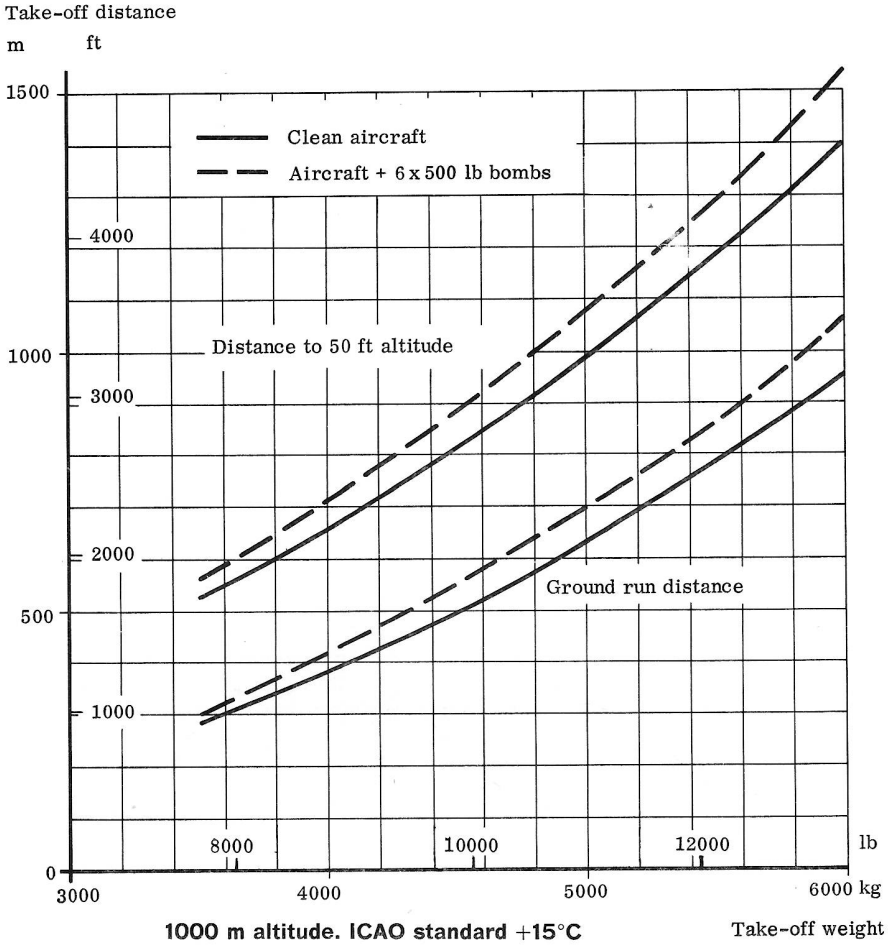


Figure 5. Take-off distance. Flaps 20°

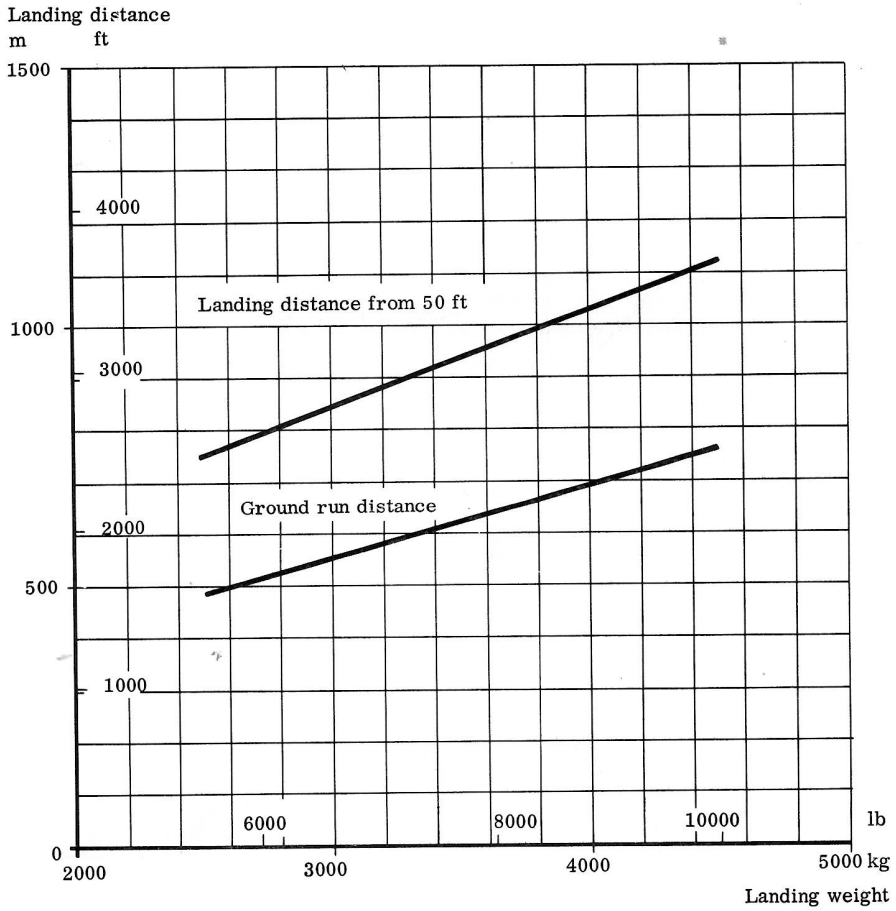


Figure 6. Landing distance (Sea level, ICAO standard). Flaps 45°

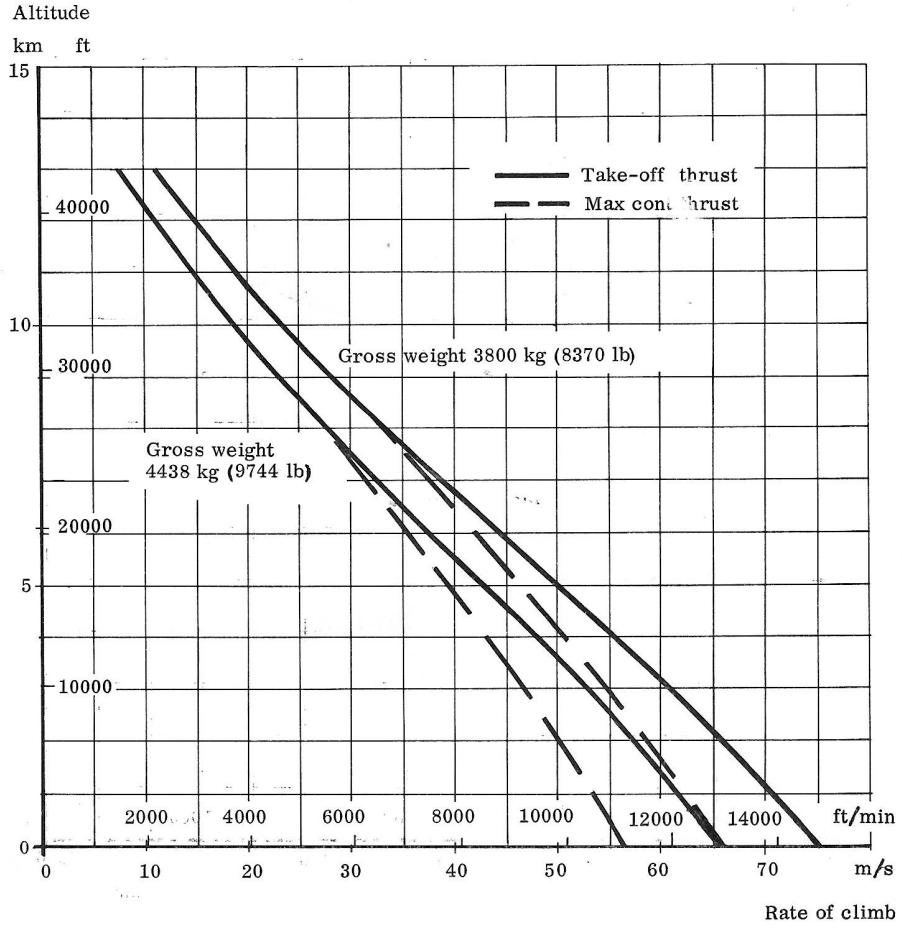


Figure 7. Rate of climb. Clean aircraft (ICAO standard)

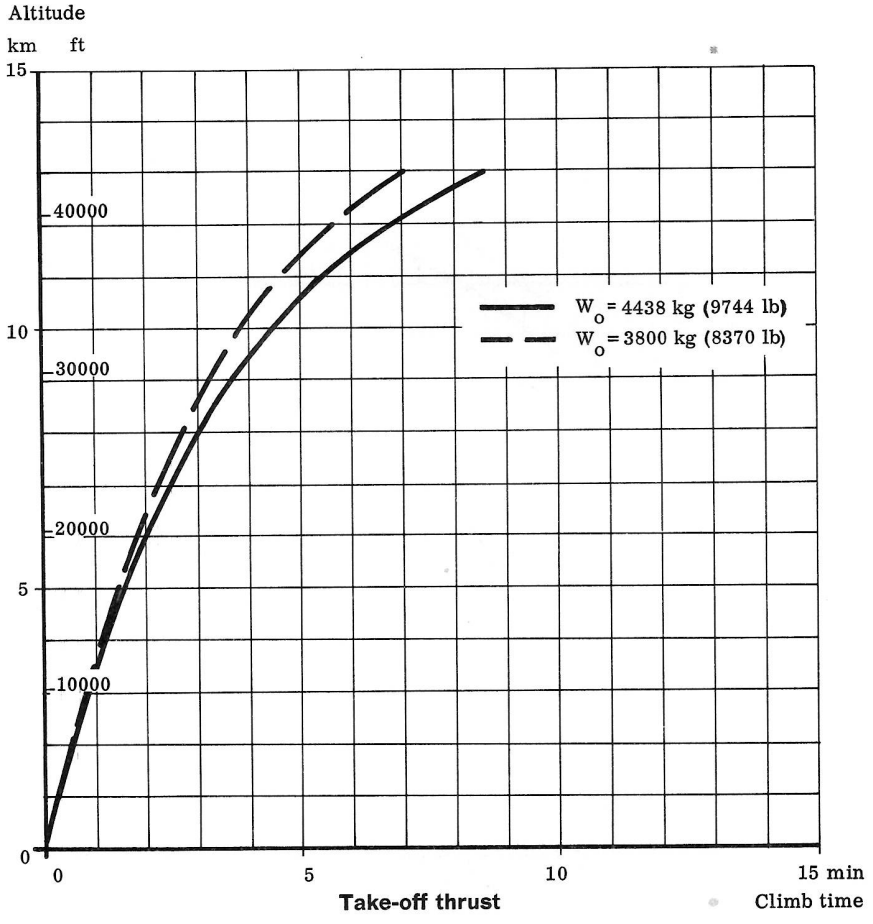


Figure 8. Time to climb. Clean aircraft.

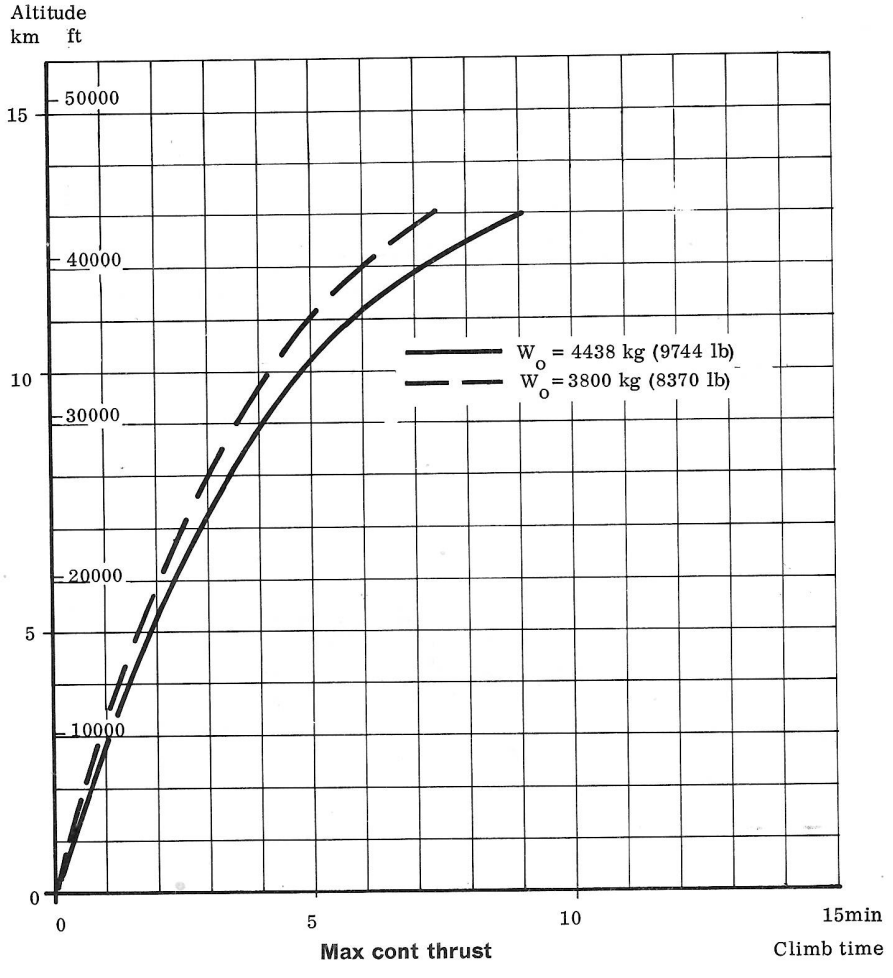


Figure 9. Time to climb. Clean aircraft.

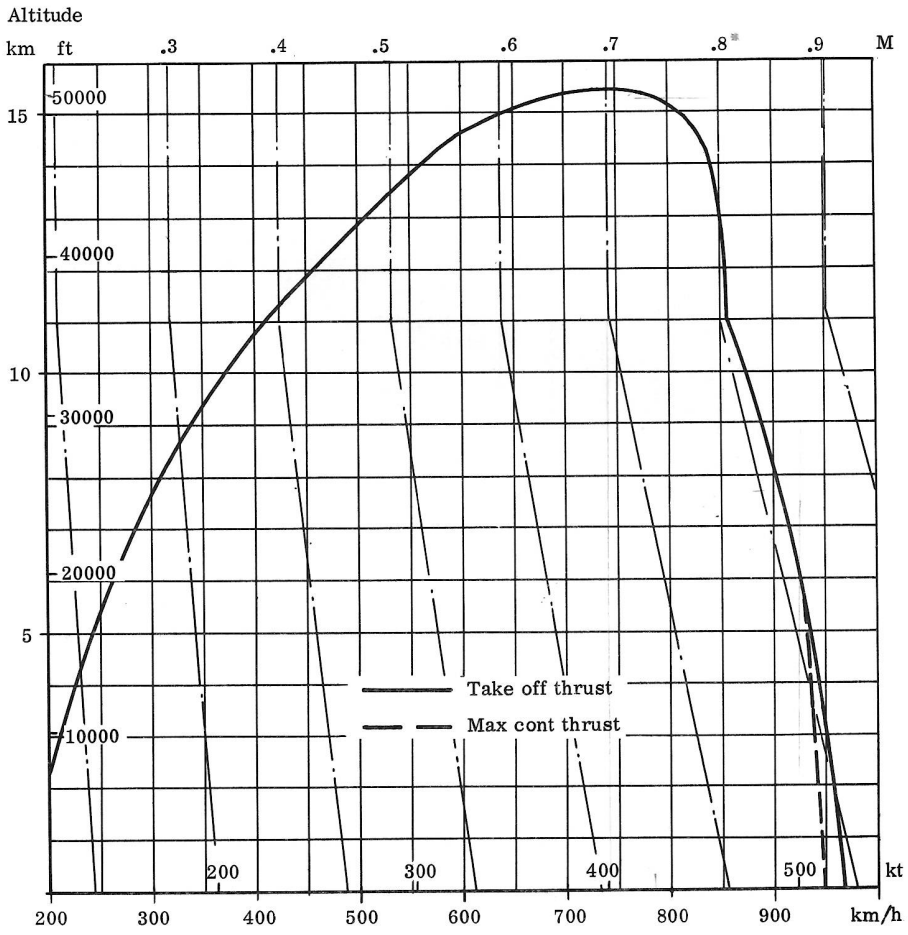
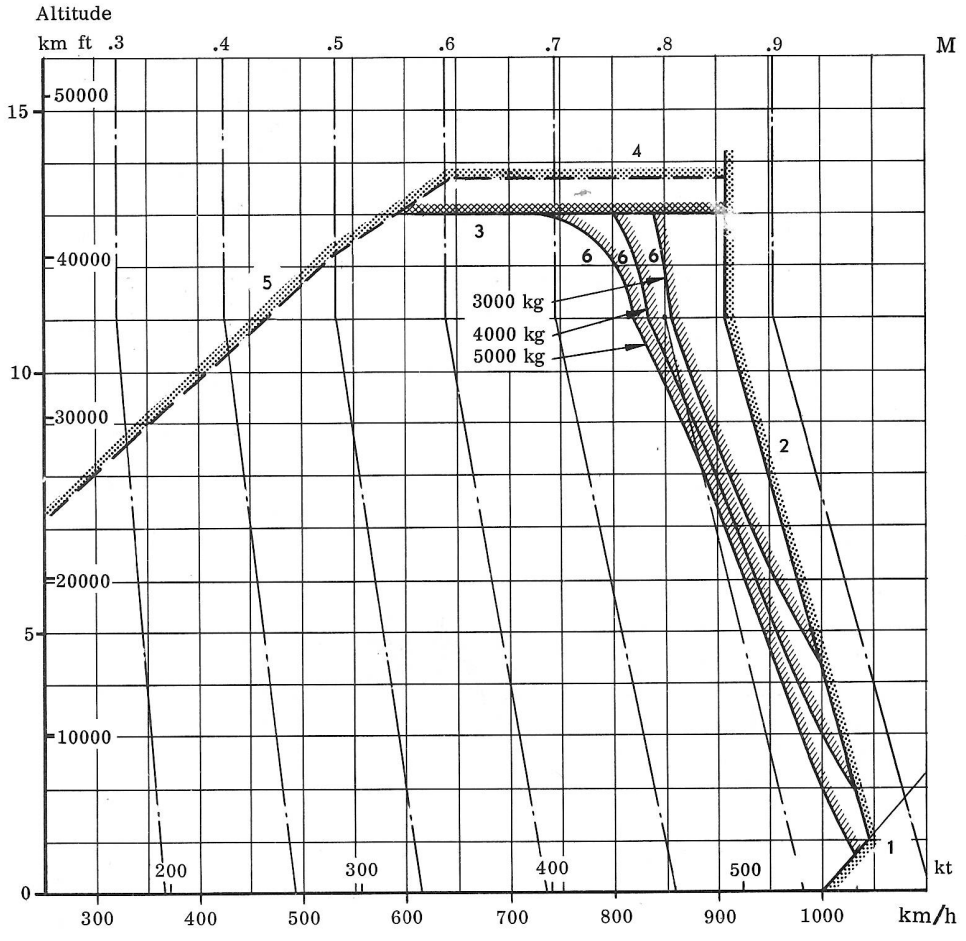


Figure 10. Equilibrium speed. Clean aircraft. Weight = 4000 kg (8820 lb)



1 Max IAS 1000 km/h (450 kt)
2 Max M = 0.86
3 Some electronic equipment is at time of writing not cleared for heights above 13 km (43000 ft)
4 Engines are at time of writing not cleared for heights above 13.7 km (45000 ft)
5 Engine low speed limitation (for all engine ratings)
6 Boundaries for incipient buffeting at $n_z = 1$

Figure 11. Flight envelope limitations.

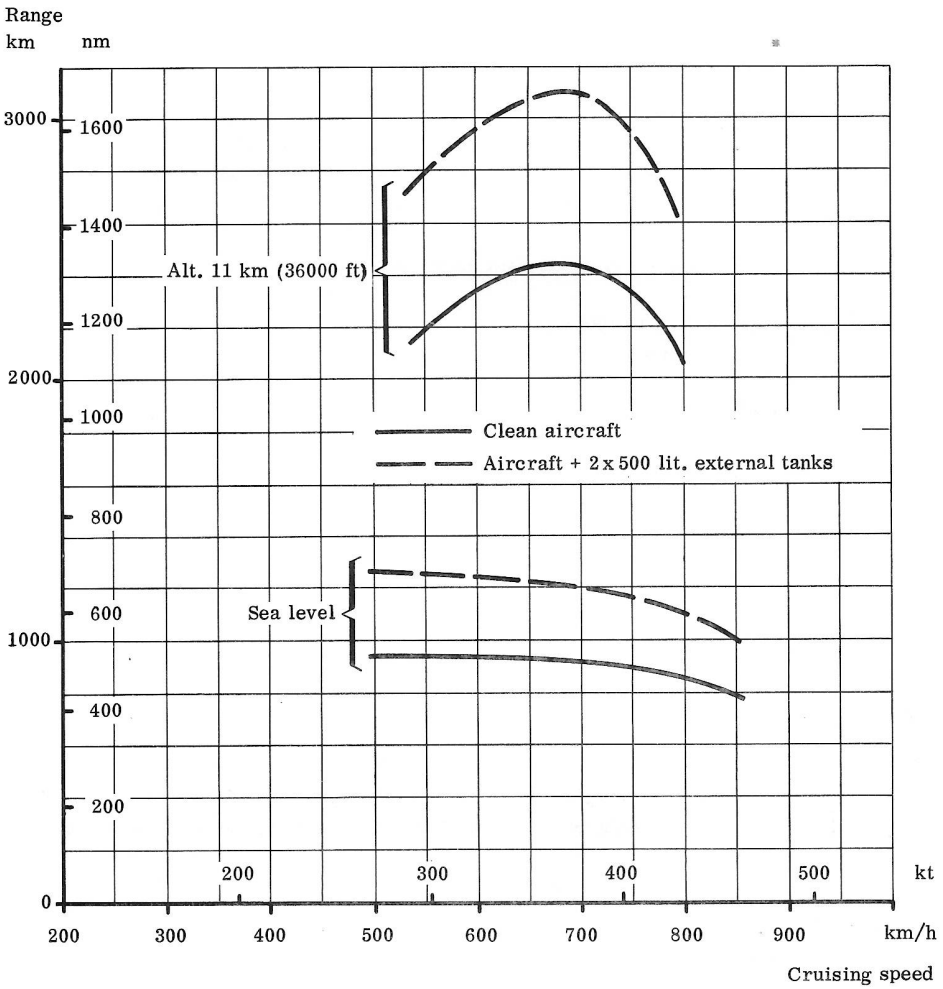


Figure 12. Ferry range including climb to cruise altitude, cruise and descent. No reserves. (External tanks are retained during the flight)

OPERATIONAL CHARACTERISTICS

The use of the SAAB 105XT is dealt with under the following headings:

Training
Ground attack
Reconnaissance
Limited fighter missions
Liaison
Target towing

(It should be noted that the following presumes that the required optional equipment is installed in each case).

Training

Flying qualities

The SAAB 105XT has been designed to meet the requirements of the Mil - F -8785 within the major part of the flight envelope. Tests and experience have confirmed that the flying qualities are generally good throughout the regime and excellent in its major part.

At the highest allowed Mach numbers slight buffeting is encountered (see fig. 11) and the stick force per g increases.

The stalling speed with full flap (45^{o}) is 160 - 170 km/h (85 - 90 knots). The aircraft is fully controllable even in a fully developed stall and is very easy to land. An artificially improved stall warning is obtained in the rudder pedals approx. 15 km/h above stalling speed.

In order to enter a spin, full prospin controls are required. The entry phase is oscillatory, but the developed spin is stable and the rotation comparatively slow, 4 - 8 secs/turn. After 6 - 7 turns the aircraft will recover by itself, even with retained prospin controls. If ailerons and rudder are centralized in an established spin, the rotation rapidly decreases.

1050-2301E-1:5/6

The low stick forces in most of the regime and the overall excellent handling characteristics make the 105XT a good aircraft for aerobatics. Loops are performed from entry speeds down to 400 km/h (recommended for pupils, Alt = 2 km, IAS = 600 km/h). Rolls are easily performed in the entire flight regime.

Safety aspects

Ejection seats and twin engine safety, combined with the excellent handling characteristics and the good view from the cockpit minimize personal hazards.

The emergency routines are simple and straightforward, although the 105 XT is a twin-engined aircraft. The location of the engines makes single engine operations easy to perform.

Instruction efficiency

The side-by-side seating gives the advantages of visual contact between instructor and pupil. For certain training missions, for example navigation training, the multi-seat capability can be used with pupils in the rear seats as well as in the left hand seat. Time to change from ejection seats to fixed seats is about one hour.

The high speed and good climb ability (time to 10000 m (33000 ft) being about 4 1/2 minutes) increase the effective time at altitude or on station. This significantly contributes to training economy.

The endurance is sufficient to perform two training flights including aerobatics of 40 minutes each without intermediate refuelling. The endurance is then calculated with reserve fuel and in addition an extra "training fuel reserve". These 80 minutes airborne time should be compared to a maximum endurance of 240 minutes (without drop tanks). See figure 13.

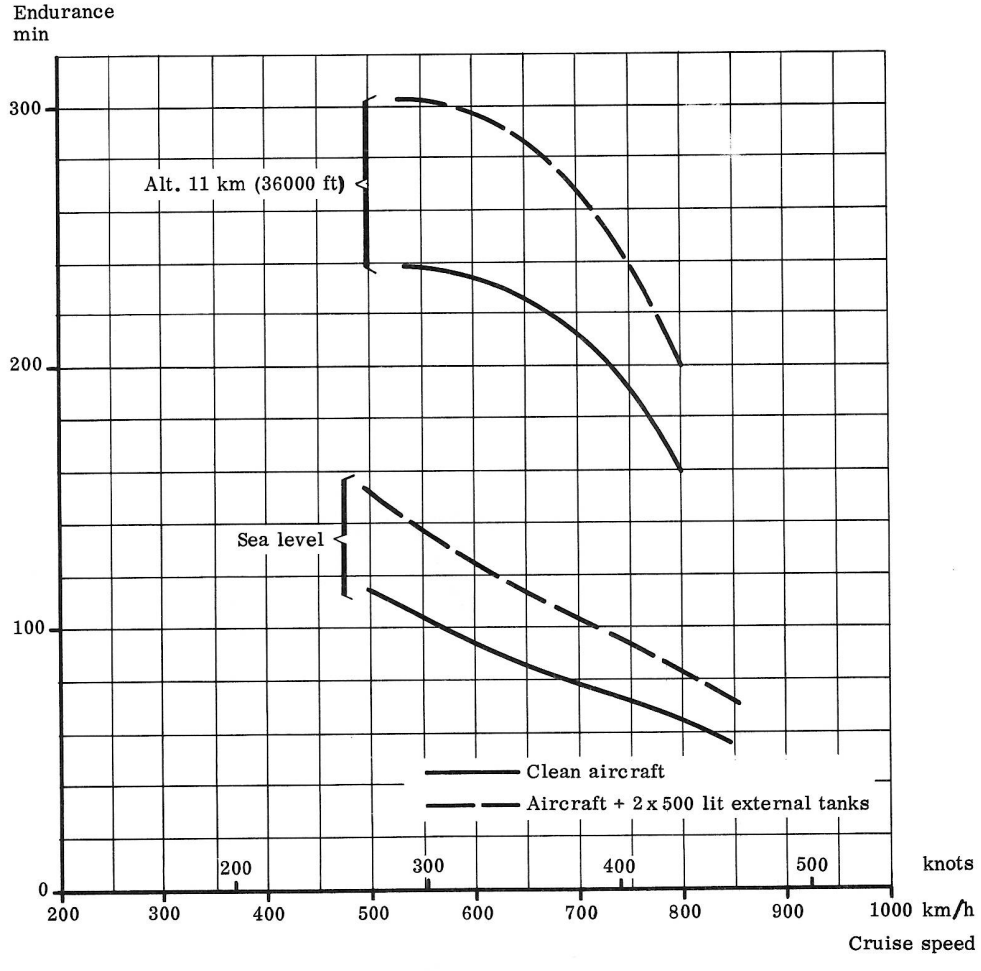


Figure 13. Endurance including take-off, acceleration, climb, cruise and descent. No reserves (External tanks are retained during the flight.)

1050-2103E-1:6

Instrument flying training is performed under hood. The standard instrumentation is adequate for IFR flying.

Combat training

As the 105XT possesses both ground attack and fighter capabilities weapon training is no problem.

As the normal flying training gradually adopts more and more combat training, the readiness for war is increased compared with a case where a specialized trainer is used. Thus the trained pupils can immediately be used for combat missions without transition training to the combat aircraft.

Ground attack

General

Surface targets can be attacked with most airborne weapon types, up to a highest unit weight of 450 kg (1000 lb). Normally, the aircraft is equipped with a gyro gunsight, giving good accuracy for gun and rocket firing. To increase bombing accuracy the aircraft can be equipped with additional devices.

Light armour can be mounted underneath the crew, primarily as protection against small arms fire from the ground.

With basic equipment, the aircraft is primarily suitable for daytime use against targets with weak to moderate air defence. With air-to-ground missiles, such as the SAAB 305A, also ground targets with heavier defence can be attacked with a good probability of success.

The self-contained engine starter system contributes to base flexibility.

Armament

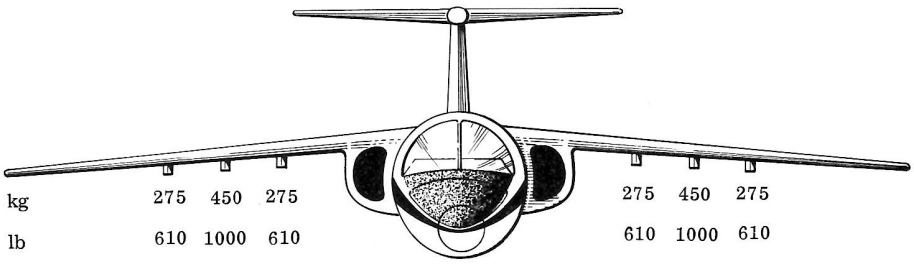
All weapons are carried externally. The aircraft has six weapons stations, three under each wing. The middle one of these is for loads up to 450 kg (1000 lb) whereas the other two are for 275 kg (610 lb).

One pylon set comprises the following:

Two pylons with 30" and 14" bomb release mechanisms, with provision for rockets (2 x 13.5 cm each).

Four pylons with 14" bomb release mechanisms and provision for rockets and IR missile (Sidewinder) launcher.

The 14" release mechanisms are of hook type. The 30" mechanisms are made for stores with T-lugs, such as the 30 mm MATRA gun pod and the SAAB 305A air-to-ground missile.



Weapons designed for other mechanisms are to be carried in adapters or special pylons.

Drop tanks are carried in the middle station on each wing in special pylons.

As space is generous (lateral distance between stations being approx 600 mm) there is great freedom in composing armament loads within the weight limitations mentioned.

Some examples of armament alternatives are given in fig 1.

Sighting equipment

SAAB 105XT can be equipped with a gyro gunsight, manufactured by Ferranti (Standard gunsight is Ferranti ISIS F-105). The ggs has modes for gun and rocket firing, giving good accuracies against ground targets, and depressed sightline for bombing.

Bombs can be dropped in a dive using a bunt mode or in a level low altitude attack mode. The latter method is used for napalm or retarding bombs (such as "Snakeye", the Swedish "Virgo" or bombs using the MATRA type 200 drag chute system).

With the bunt method the depressed sightline is held on the target, the aircraft consequently following a bunt trajectory. Bomb release signal is given manually when the distance is judged to be correct. The method is chosen as it greatly reduces the sensivity to distance errors. The accuracy is such however that targets needing pinpoint precision should preferably be attacked with more refined methods. The bunt methode also brings the aircraft rather close to the bomb blasts, which restricts the size of the bombs to be used.

If better accuracy with bombs is required, a special bomb sight should be chosen. Primarily recommended is the SAAB BT9R dive bomb sight, with laser ranging. The bombs are automatically released in a pull-up after a dive towards the target. This gives good precision and also gives the pilot a high degree of tactical freedom in maneuvering and assures the best clearance from the blasts of the bombs.

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Air-to-surface missile installation

The aircraft has provision for carrying two SAAB 305A missiles. It can also be equipped to carry other missiles, such as Bullpup A or AS20.

The control column for missile guidance will be placed between the seats, so that it can be handled by both crew members. Simulator studies show that the difference in control accuracy between control with right or left hand is almost negligible. If the pilot steers the missile, he can if desired temporarily give over control of the aircraft to the navigator.

SAAB 305A has the advantage that it can be fired against a target well aside of the aircraft's flight path. This results in a greater distance from the target's air defence than for missiles that have to be fired almost straight ahead, and it allows the aircraft to maneuvre after the missile is released.

Navigation

The aircraft is prepared for the following navigation and communication equipment:
One VHF and one UHF with Audio Control
One VOR/ILS with marker beacon
One ADF
Other navaid or communication equipment could be specified.

Without a precision navigation system, low level approach navigation will have the character of terrain orientation. In this respect the two-seater capability is valuable, since experience shows that the ability both to reach and to detect the target is increased if a navigator is carried. The navigator in 105XT has the same good forward view as the pilot.

The off-loading of work from the pilot to the navigator permits flight at lower altitude, giving increased protection, and a better watch for enemy aircraft. As previously mentioned, the navigator can also serve as a missile gunner.

High altitude approach and return

High altitude cruising to and from the target can be used when the probable enemy counteraction is weak, and when surprise is not essential. The advantages are longer radii of action and less strain on the crew. The normal procedure is to descend to a low altitude dash some distance before the target. The length of this dash has great influence on the radius of action as is shown in figure 14, which give the radius of action for some hi-lo-hi missions with up to 100 km low altitude dash and with different weapon alternatives.

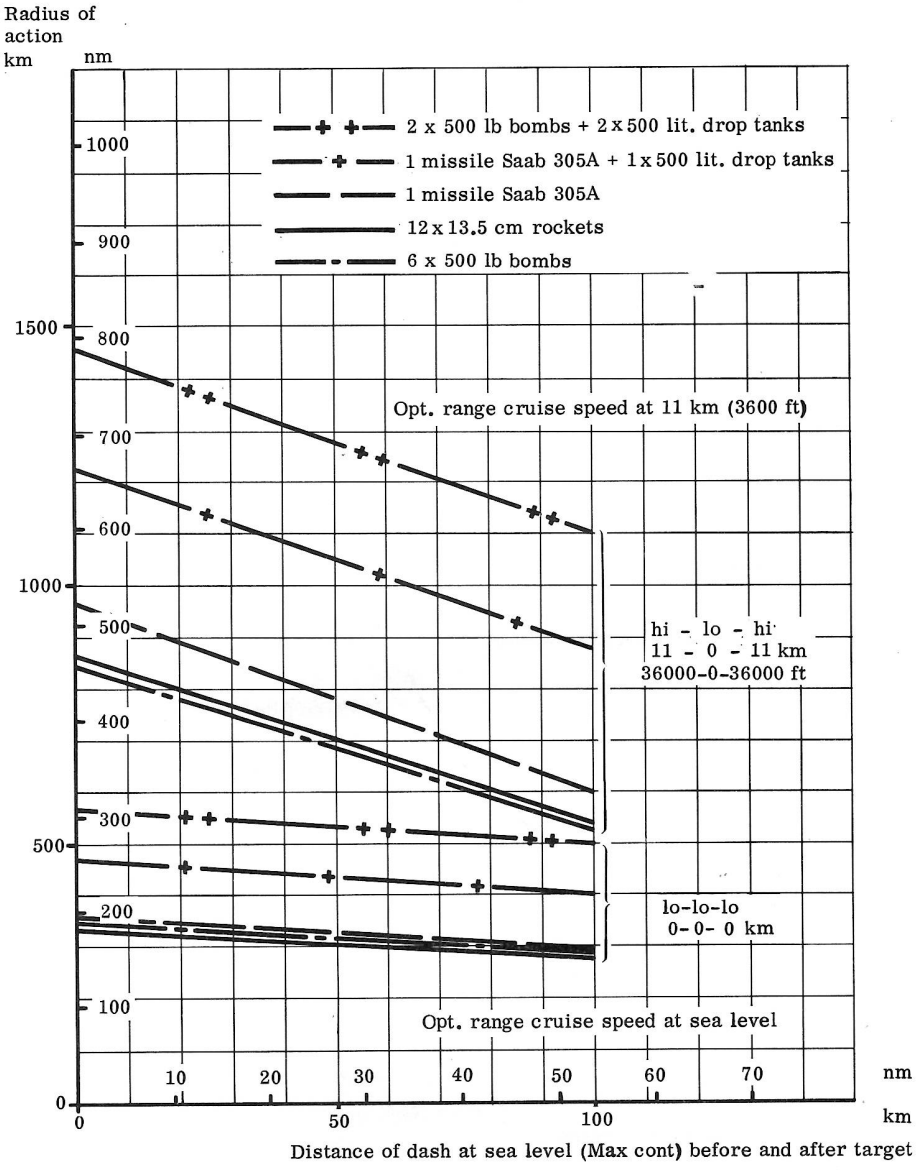

Figure 14. Influence of dash distance at sea level on radius of action. (2.5 min combat. 5 and 10 % fuel reserve at hi-lo-hi and lo-lo-lo missions respectively)

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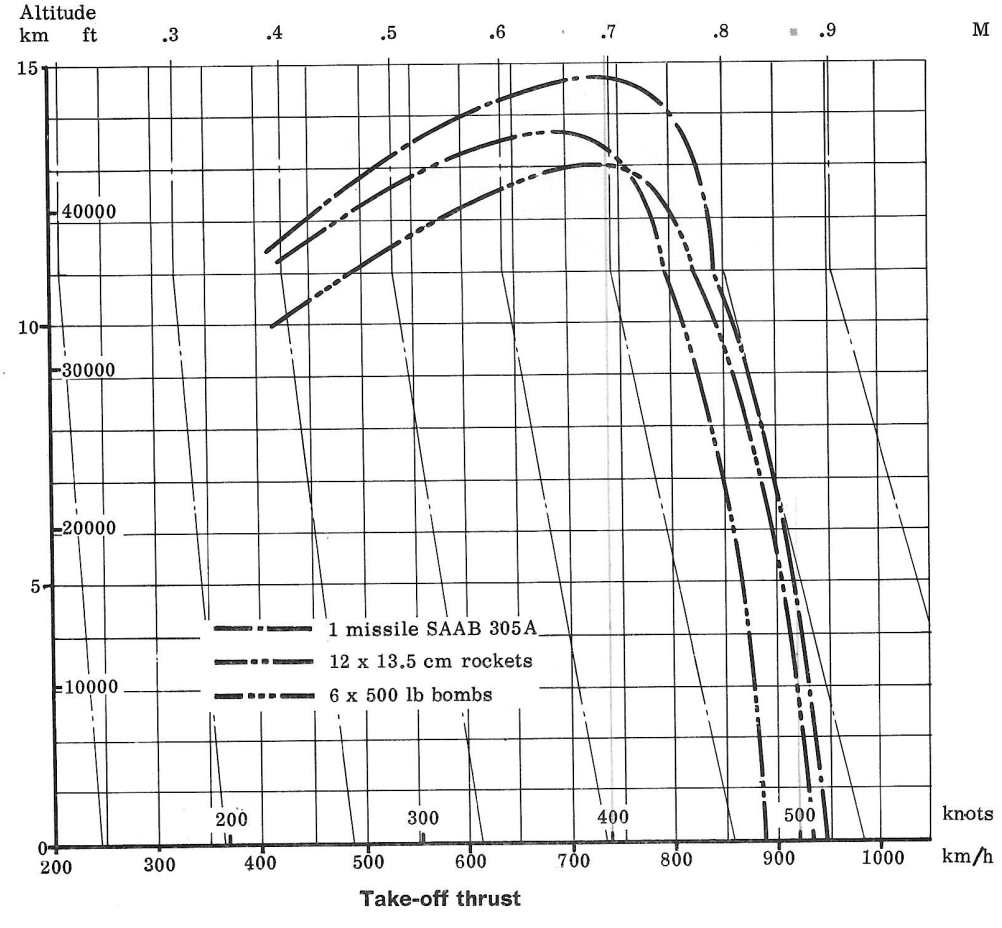

Figure. 15. Equilibrum speed with different armament alternatives.
$n_z = 1$

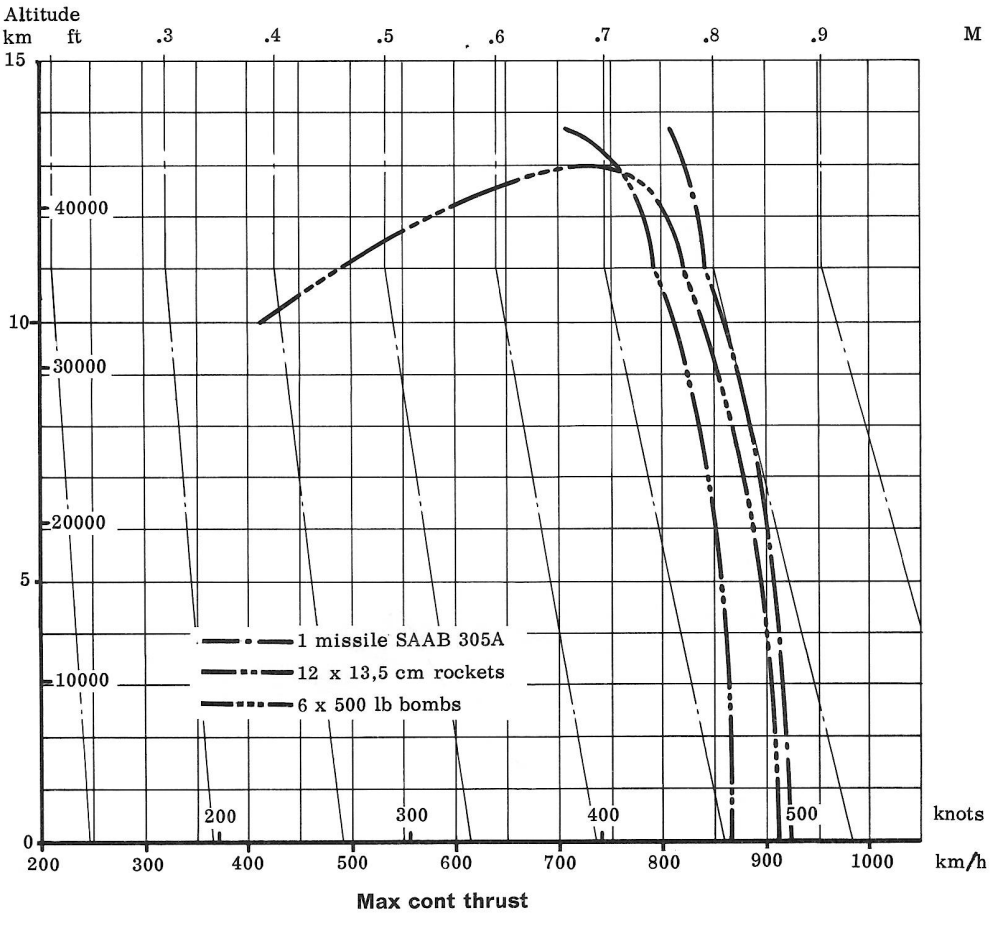

Figure 16. Equilibrum speed with different armament alternatives.
$n_z = 1$

Recommended cruise altitude is 10 to 12 km. Distance optimum Mach number is here 0.60 to 0.65. With some sacrifice of range the Mach number can be increased to about 0.76 with 6 x 500 lb bombs, and to about 0.78 on the return leg. On the deck dash speed with max. cont. thrust will be M = 0.7 to 0.75 depending on the load. See figure 16.

These speeds are so high that for an air defence with subsonic fighters very high demands are put on vectoring accuracy and pilot skill if the 105XT's are to be met efficiently.

The excellent maneuvering capabilities of the 105XT give it a good chance of avoiding combat by maneuvering down to low altitude, or even of outmaneuvring an opponent. See further the section about fighter use.

Low altitude approach and return

In areas with enemy air defence or when surprise is essential the cruising phase is also made at low altitude. Close to the target a high speed dash is performed. How the length of this dash influences range is shovn in figure 14, which gives the radius of action for some lo-lo-lo missions with up to 100 km dash.

The best Mach number for distance at low altitude is M = 0.5 to 0.6. The sacrifice in range for a speed increase is small however, as can be seen in figure 14. With max. continuous thrust and 6 x 500 lb bombs M = 0.74 is reached and with bombs dropped M = 0.77.

These speeds are so high that subsonic fighters will have difficulty in countering an attack effectively. Experience shows that the possibilities of success for the fighters rapidly decrease when the speed ratio falls below about 1.2. To be efficient against the 105XT at high speed, the fighters must be able to operate at around M = 0.9, a high figure for many fighters still in use.

Regarding dash speed the SAAB 105XT differs favourably from most other trainer/attack aircraft.

The 105XT can also be equipped with self-defence weapons such as gun pods or Sidewinder missiles, and is thereby not a harmless prey for the fighters. Gun pods have the advantage of being both ground attack and fighter weapons.

Weapon alternatives including self-defence weapons are:

- 4 x 500 lb bombs + 2 x 30 mm gun pods
- 2 x 1000 lb bombs + 2 x 500 lb bombs + 2 Sidewinders
- 8 x 13.5 cm AS rockets + 2 x 30 mm gun pods

Figure 17. The SAAB 105XT makes a steady platform for weapons delivery

The attack

During the actual attack the 105XT must expose itself to the target anti-aircraft defence. In this respect the conditions are the same as for other ground attack aircraft.

The time of exposure, assuming exact navigation, is fairly independent of the speed, and thus conditions in this respect are not notably worse for the 105XT than for faster aircraft. A small difference due to the increased accuracy for anti-aircraft guns at the shorter firing distances is however expected.

Owing to its lower speed the 105XT has shorter firing or bombing distances, resulting in higher accuracy for the same sight equipment. Expressed otherwise, the faster aircraft must make use of more expensive sight equipment to compensate for the lowered accuracy.

The comparison with faster and heavier attack aircraft is favourable for the 105XT also in another respect. For the same amount of money, more airplanes and crews can be obtained, whereas the weapons load fired is roughly constant. This results in a better saturation of target defences.

Also with these advantages for the trainer/attack aircraft class, there would be a natural division of targets between the 105XT and heavier and faster attack aircraft, so that these attack heavily defended targets far from the frontier whereas the 105XT aircraft are used against less well defended targets with lower demands for penetration of enemy territory.

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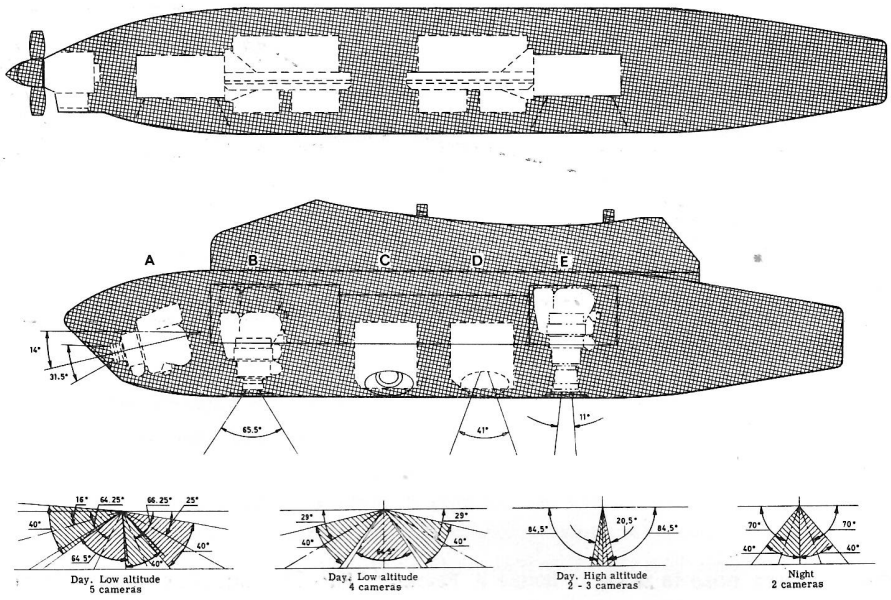

Figure 18. Flash pod and camera pod

Reconnaissance

For photographic reconnaissance the 105XT can be equipped with a wing mounted camera pod or with a camera nose.

The pod, which is shown in fig 18, has windows and beds for one forward mounted and four downward-sideways mounted Vinten 70 cameras, permitting for example the following alternatives.

Camera pos.	Day. Low alt. 5 cameras	Day. Low alt. 4 cameras	Day. High alt. 2-3 cameras	Night. Low alt. 2 cameras
A Forw. oblique	101 mm f/2.0	101 mm f/2.0	(101 mm f/2.0)	-
B Downw	44 mm f/2.8	44 mm f/2.8	304 mm f/4.0	76 mm f/2.8
C Left oblique	76 mm f/2.0	76 mm f/2.0	-	-
D Right oblique	76 mm f/2.0	76 mm f/2.0	-	-
E Downw	76 mm f/2.0	-	304 mm f/4.0	76 mm f/2.8

For night photography the camera pod is supplemented by a flash pod with two flash units of Chicago Aerial manufacture.

The installation (including hot air supply) locates the camera pod in the port outboard and the flash pod in the starboard inner weapons point. Due to these locations the masking effect of the fuselage is minimized, and the ability to carry drop tanks, self-defence weapons and countermeasure pods is retained.

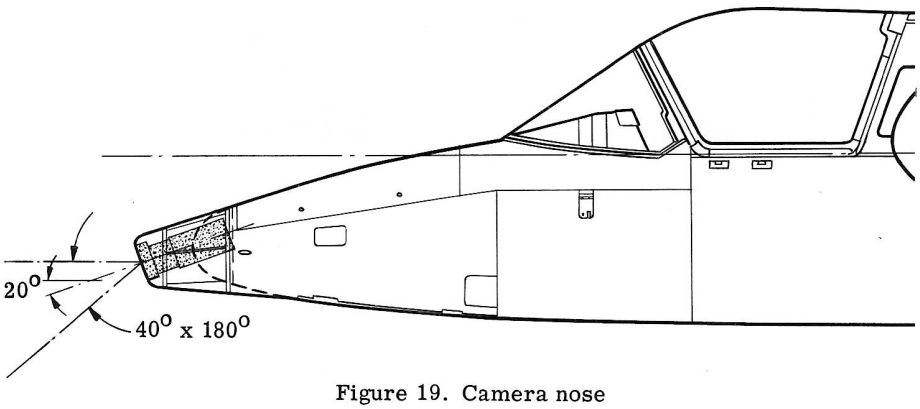

Figure 19. Camera nose

The camera nose is made to house a Fairchild KB-18 panoramic camera with the following characteristics:

- Lens	76 mm f/2.8
- Film width	70 mm
- Field of view	180^{o} x 40^{o}
- Picture size	238 x 57 mm

The effect of the special nose on aircraft performance and characteristics is negligible.

The nose camera is suited for strip photographing from low altitude during daytime. Meaningful photography may be performed from 1 - 2 km altitude, assuming enemy counteraction is weak. The normal, however, is considered to be low level photography from 50 - 200 m, where the aircraft also can operate over defended terrain.

Both the above alternatives leave the aircraft's usefulness for ground attack and other missions unaffected. Even combined attack and reconnaissance missions can be performed, in the camera nose alternative with full load of offensive weapons.

A tape recorder can also be included in the reconnaissance equipment.

The ability to carry recce equipment, the long range and the excellent view from both seats makes the 105XT well suited for reconnaissance. Its speed and self defence capabilities also enable it to work in hostile environments. Against a strong air defence the 105XT is a suitable complement to heavier and faster reconnaissance aircraft, with a natural division of targets as for the attack missions.

Limited fighter mission

Armament and sight

The following weapons can be used against airborne targets:

30 mm cannons, 7.5 cm or 2.75 in. Air-to-Air (AA) rockets, IR-missiles (e.g. Sidewinder) and the SAAB 305A missile.

Miniguns are considered primarily as air-to-ground weapons.

30 mm cannons are effective against all kinds of airborne targets.

Existing AA rockets are effective against all kinds of airborne targets. Both rocket pods and free-hanging AA rockets can be carried. The Sidewinder is however more economical in use than AA rockets on account of the higher kill probability.

The SAAB 305A missile is a good weapon for use against large airborne targets (cargo and transport aircraft). It is however more expensive than many IR-missiles, which can be successfully used against these targets also.

Suitable fighter armament alternatives are consequently

- 2 x 30 mm gun pods + 2 - 4 Sidewinders
- 2 - 4 Sidewinders
- 2 x 30 mm gun pods
- 2 x AA rocket pods
- 22 free-hanging AA rockets

The standard sight of the 105XT is a Ferranti ISIS F-105 gyro sight. The installation provides fixed range settings for the weapons in use. For guns two different firing ranges can be chosen. The aiming symbol, a Celtic cross, permits judgement of firing range.

Performance

The max. level speed with the armament alternatives mentioned above is about M 0.75 at low altitude and about M 0.77 at the best altitude (8 km).

The rate of climb is high compared to other aircraft of the same class. Time to 10,000 m (33000 ft) is about 7 minutes with a normal fighter armament. See figure 20 and 21.

The maneuvrability is good. Steady-state load factor is about 6 at low altitudes and about 2 at 10,000 m (33000 ft).

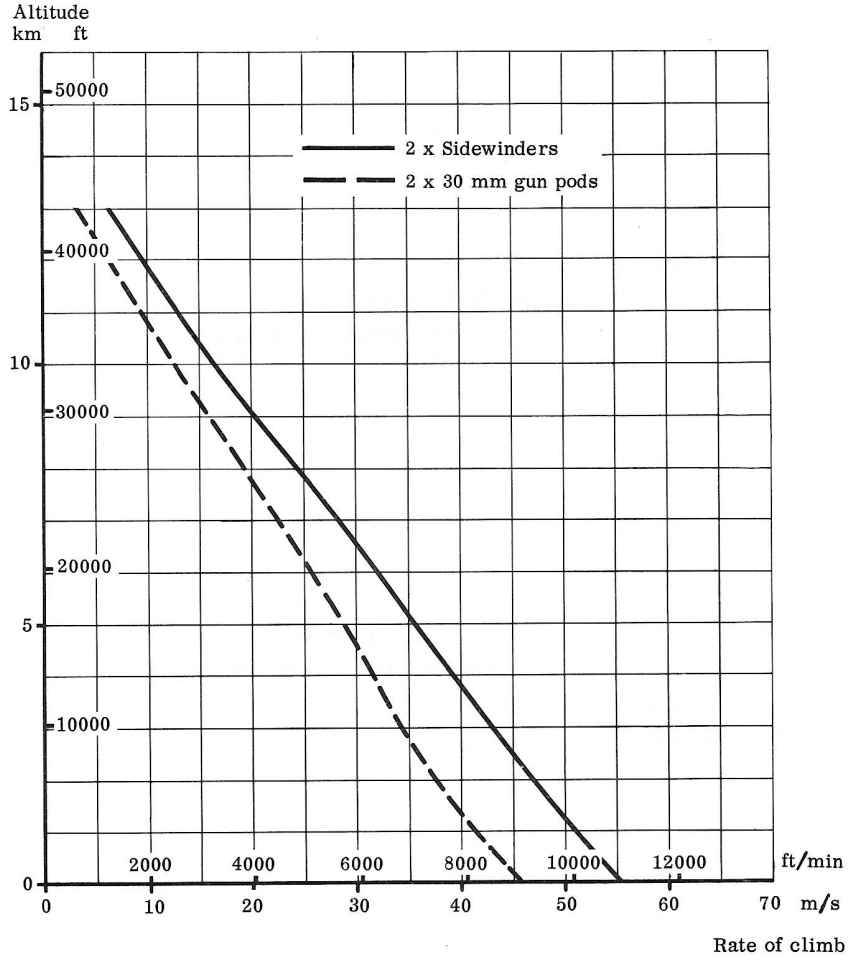

Figure 20. Rate of climb for different armament alternatives. Take-off thrust.

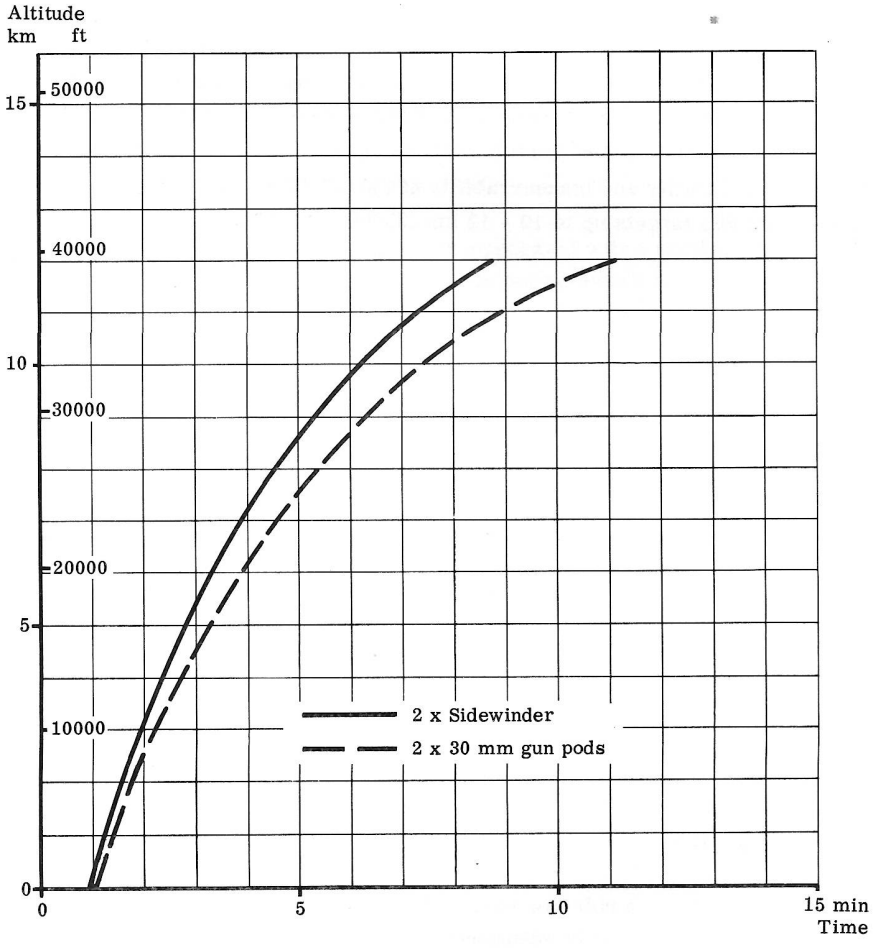

Figure 21. Time to climb from brakes off for different armament alternatives. Take-off thrust.

Fighter use

The 105XT has good possibilities of combatting airborne targets with target speeds M ≦ 0.65 with all kinds of possible fighter armaments. It has also limited possibilities of combatting targets with target speeds M = 0.65 - 0.75, especially with Air-to-Air missiles.

The good maneuvrability gives it a good possibility of surviving any dog-fight. The best turning speed of most modern fighters is M = 0.5 - 0.6 at low altitudes, and this is a suitable speed also for the 105XT. This gives the aircraft a good chance of breaking fighter blockades at low altitudes over air bases etc. It also has a limited ability of threatening escort fighters if the escort object's speed is M ≦ 0.75.

The climbing ability and maneuvrability of the 105XT makes it useful as a fighter against suitable targets up to 10 - 12 km (33000 - 40000 ft).

Liaison

SAAB 105XT can be turned into a four/five seater by replacing the two ejection seats with two fixed forward seats and two rear seats or a rear bench seat. The change is done in less than one hour. Also one pilot seat, one rear seat (for a medical attendant) and a stretcher can be arranged.

The spacious cabin enables the 105XT to carry comparatively large items, such as spare parts. With only the pilot's seat mounted there is at his side a volume permitting an object with max length 210 cm, max width 50 cm and max height 90 cm approximately, (83, 20 resp 35 inches) in addition to a considerable space behind the pilot.

In the combat liaison role the ability of the 105XT to transport airborne weapons in the wing pylons should be mentioned.

The range with four people and luggage is, including 20 min reserves, 2210 km (1200 nm) at 11 km (36000 ft).

Adding two 500 lit (130 US gall) external tanks (retained during the flight) extends the range, including 30 min reserves, to 2760 km (1490 nm).

Experience shows that a fast liaison aircraft is invaluable. In actual operations, situations occur constantly which can be handled only by using a high speed aircraft. With no fast liaison aircraft available, a combat aircraft may have to be withdrawn from its normal use.

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Target towing

The SAAB 105XT can be equipped with a tow reel and a target launcher under the wings. The launcher can carry, release, tow and recover the target in flight. The equipment is carried in the 105XT's pylons for external armament. A separate control panel can be plugged in and fitted to the instrument panel in front of the right hand panel in the cabin.

Tow reels and targets of different manufacture may be used, including sleeve targets. As an example an installation using the Del Mar DX-5 tow reel and the DL-45 target launcher is described in the following.

The tow reel and target are both carried under the port wing, leaving the space on the starboard wing for a possible external tank.

Asymmetry during take-off and landing is compensated with a spoiler on the starboard wing. Asymmetry during normal flying is not noteworthy.

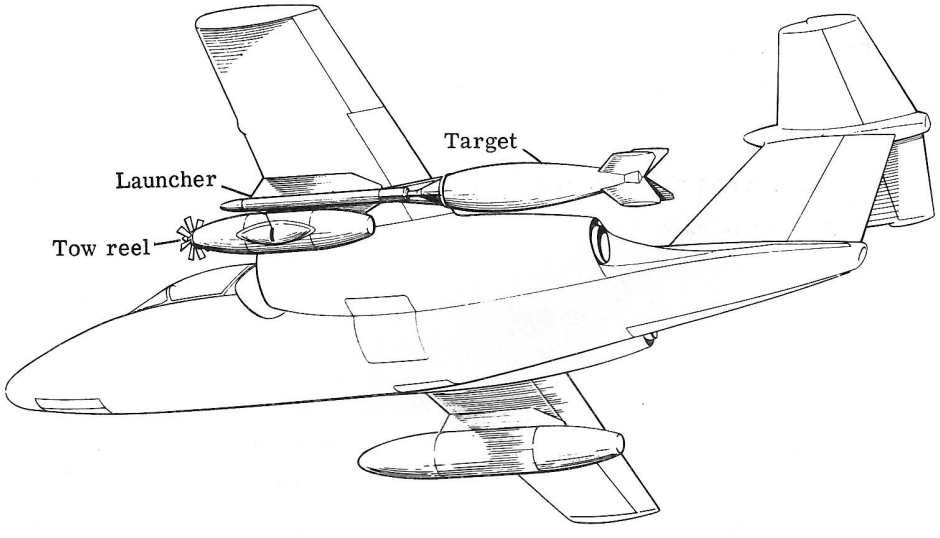

Figure 22. SAAB 105XT with target towing equipment and external tank

Equipment

Tow reel	Del Mar DX-5A
Launcher	Del Mar DL-45 (modified)
Target	Del Mar DF-4MFC with radar reflector and installation for flares, IR torches, smoke signals and hit indicators.
Control panel	Del Mar type

Reel performance

Roll out speed		0 - 600 m/min
Reel-in-time	2000 m (6600 ft) tow line	about 4 min
	6000 m (20000 ft) tow line	about 12 min
	10000 m (33000 ft) tow line	about 20 min

Aircraft performance

Maximum ind. air speed		
with suspended target	500 km/h	270 kt
with sleeve target, tow line 2000 m (6600 ft), diam 2.3 mm	450 km/h	240 kt
with DF-4MFC, tow line 6000 (20000 ft), diam 1.3 mm	M = 0.75 or 650 km/h	M - 0.75 or 350 kt
Maximum altitude for target towing	11000 m	36000 ft
Flying time in target area assuming 100 km (54 nm) to and from target area and with 20 % reserve fuel.		
Sleeve target at 3000 m (10000 ft)		
No external tank	75 min at 450 km/h	75 min at 240 kt
One external tank	95 min at 450 km/h	95 min at 240 kt
DF-4MFC target at 10000 m (33000 ft)		
No external tank	60 min at 800 km/h	60 min at 430 kt
One external tank	75 min at 800 km/h	75 min at 430 kt

Average flying speed during inreeling is around 550 km/h (300 kt).

Outreeled tow-line length can be read directly from the control panel.

MAINTENANCE

General

Maintenance, inspection and repair were given very careful consideration right from the start of the design. The cooperation of the Swedish Air Force was sought on this matter, to ensure that their severe requirements could be met. These include:

Low operating cost
Easy access for service and replacement
Short turn-round time between flights
Minimum of required maintenance and overhaul

What makes Swedish Air Force requirements special is that conscripts for military duty without professional training constitute the majority of the service personal, and are also used for a large proportion of the repair work. The influence on aircraft maintainability, equipment, catalogues and manuals is obvious.

To give an example, turn-round between training flights is performed by one conscript in 15 minutes.

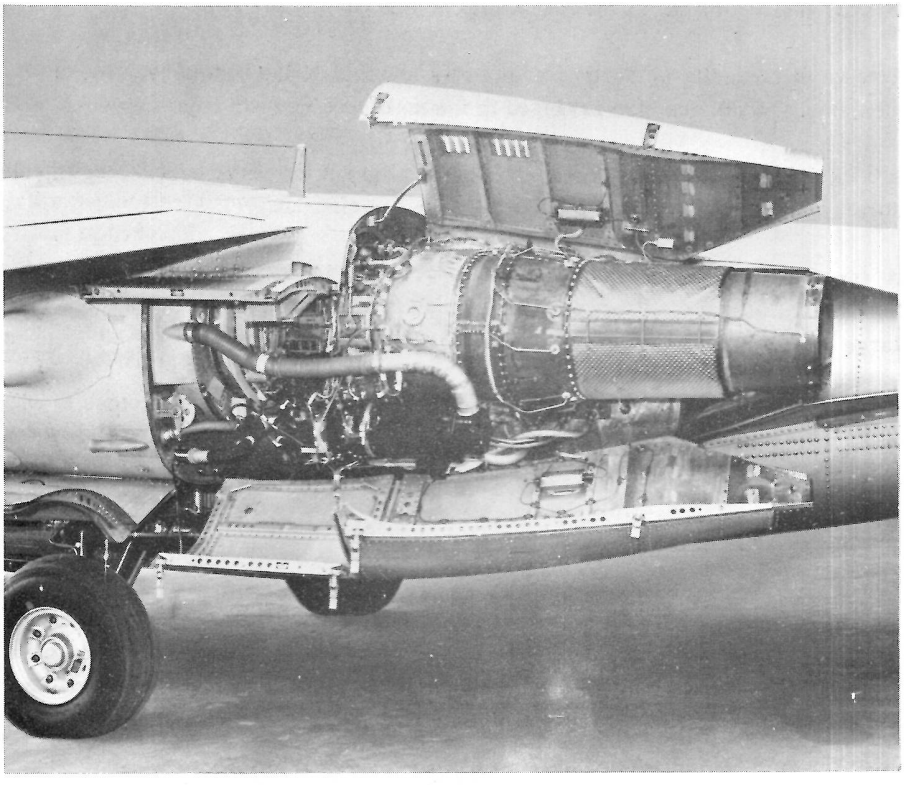

Figure 23. Four large hatches give complete access to each engine

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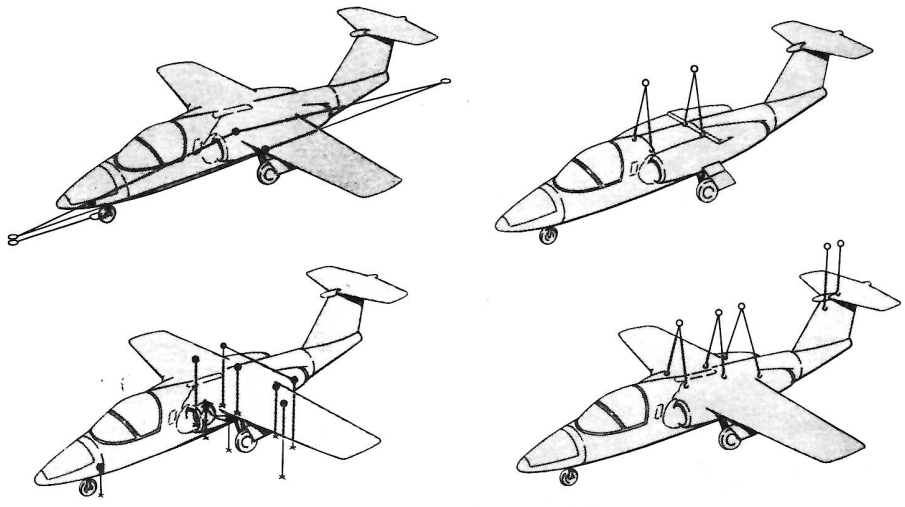

Figure 24. Major points for towing, lifting and jacking

Some design arrangements

Pressure fuelling is performed through a connection in the starboard wingtip, keeping fuelling equipment and personnel out of the way of other work. Fuelling stops automatically when the tanks are full.

Gravity fuelling through overwing points is also possible.

Towing is normally performed with a fork attached to the nosewheel. Alternative attachment points are also arranged in the main landing gear legs.

A hook attachment point is provided on the port side of the nose, behind a crushable cover, to facilitate dragging away a belly-landed aircraft.

A large number of hoisting and lifting points are provided and matched to hoist heads and lifting tools. They facilitate handling of the entire aircraft as well as of large units.

For ease of wheel replacement, special jacking points are provided close to each of the three wheels.

Interchangability of parts

A high degree of interchangeability is provided, which is also a necessity in view of the way the Swedish Air Force uses conscripts for much of the field work. Thus all equipment units and other units which may need regular replacement during overhauls are immediately interchangeable, as are units open to outer damage. Other units may require some, generally slight, trimming on installation.

Detailed and instructive descriptions, catalogues and manuals complete the picture.

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Accessibility

A large number of suitably located hatches facilitates access. The most frequently used hatches are equipped with quick-action fasteners. For example, almost the entire engine installation is laid free by opening the engine access doors.

The entire overside of the nose is one large hatch with four quick-removal screws. Removal gives access to the forward equipment bay, housing navigation and communication equipment.

The doors of the rear equipment bay and hydraulic bay are secured with screws. A lower equipment bay, housing batteries and other electric equipment, is easily accessible through a hatch with quick fasteners.

All points for frequent filling and inspection are placed behind small hatches with quick acting fasteners, even when this means a small hatch in a bigger one. Thus at turn-round no large hatch need be opened.

The equipment doors are located so that usually no ladders are required and most work can be done from a comfortable standing position.

Typical maintenance times	minutes	No. of servicemen
Turn-round incl. fuelling	15	1
Fuelling 2050 litres (540 US gallons) at 3.5 atm. pressure	12	1
Filling of oxygen	2	1
Filling of air for brake accumulator	2	1
Main wheel replacement, per wheel	10	1
Nose wheel replacement	25	1
Brake replacement, per wheel	60	2
Filling of hydraulic oil	5	1
Engine replacement per engine	3.5 hours	2
Mounting standard set of weapon pylons	30	2
Substituting two ejection seats for four standard seats	1.0 hour	2

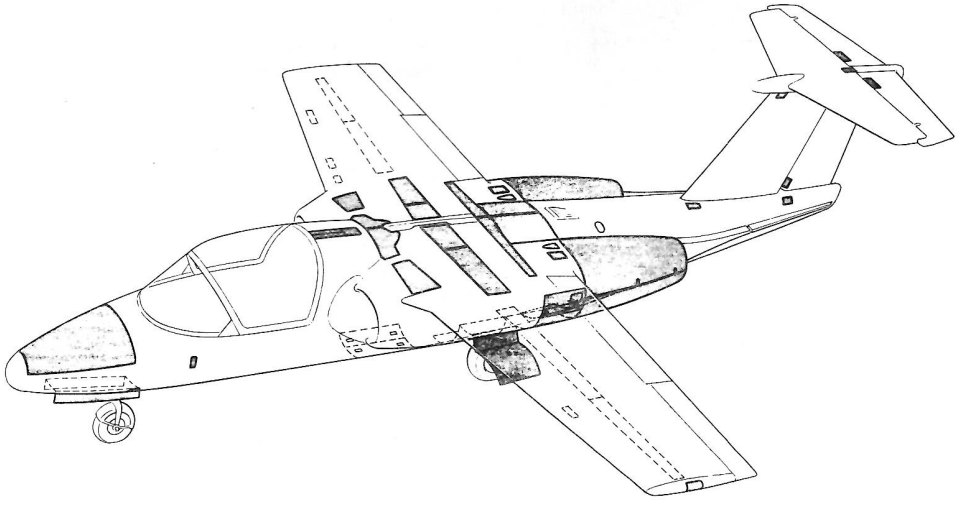

Figure 25. Location of major hatches

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Recommended maintenance cycles

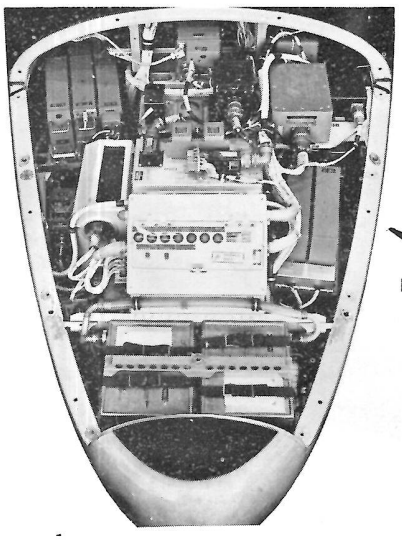
The periodic actions are designated by letters. Up to an annual flying time of 300 hours, the schedule is entirely based on calendar-time.

Assuming a standard equipped aircraft flown 300 h/year, 15 days/month and an average of 0.9 hour/mission, a four year cycle will look as follows (weapon handling is not included).

Inspection type	When performed	Man-hours required	No. at 4-year cycle	Total man-hours	Working level
A	Before each flight	1/4	1330	332	Flight-line level
B	Each flying day	1	720	720	
C	Every 45 days (calendar)	6	16	96	
D	Every 3 months (calendar)	16	8	128	
E	Every 6 months (calendar)	120	4	480	Field level
F	Every 12 months (calendar)	160	2	320	
G	Every 24 months (calendar)	200	1	200	
H	Every 48 months (calendar)	400	1	400	
		Total		2676 mmh	or appr. 2.25 mmh/fh

Adding also depot level work gives (in maintenance man-hours per flight hour):

Airframe (as above)	2676 mmh/1200 fh =	2.25 mmh/fh
Accessories	1130 mmh/1500 fh =	.75 mmh/fh
Engine overhaul	2 x 700 mmh/2400 fh =	.60 mmh/fh
Engine hot section insp.	2 x 75 mmh/400 fh =	.40 mmh/fh
	Total	4.00 mmh/fh



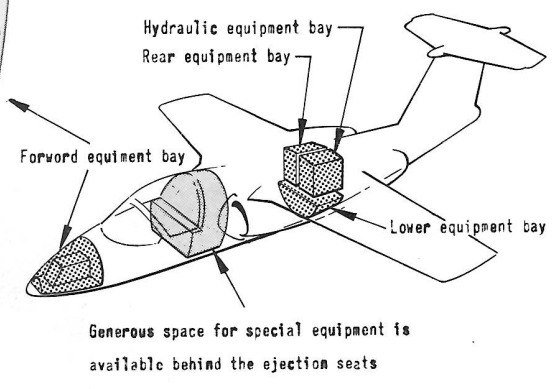


Figure 26. Location of major accessories compartments

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Endast för spridning utomlands